EQUIPMENT AND METHODS FOR THE COLLECTION OF HIPPOBOSCID FLIES FROM TRAPPED CALIFORNIA VALLEY QUAIL, LOPHORTYX CALIFORNICA VALLICOLA (RIDGWAY), (DIPTERA).

By I. Barry Tarshis,[1] Berkeley,[2] California

Introduction[3]

For many years the problem of obtaining hippoboscid flies from birds has been a major stumbling block in carrying out research work with these flies. The literature is almost totally devoid of information on methods for collecting avian Hippoboscidae. As far as the writer has been able to ascertain, O'Roke (1930) and Herman (1944) are the only workers who have described techniques for taking these flies from birds. Both of these men worked with the Hippoboscidae of California quail.

O'Roke's method was to shoot the quail in an open clearing so that he could recover it quickly, before the escape of the flies from the quail. The bird was placed in a conical gauze bag which was then suspended with the apex of the cone upward. As the flies left the dead bird they ascended toward the apex where they were collected in shell vials. This technique yielded some flies. *Lynchia hirsuta* Ferris was the only species that O'Roke was able to find on the quail.

[1] Predoctorate Research Fellow, National Institutes of Health.

[2] Division of Entomology and Parasitology, University of California.

[3] This work has been done under the direction of Dr. M. A. Stewart whose supervision and help is deeply appreciated. The writer is also grateful to Dr. Joseph Bequaert of the Museum of Comparative Zoology, Harvard University, Dr. C. M. Herman, Patuxent Research Refuge, and Mr. Merton Rosen, Disease Laboratory, California Division of Fish and Game, for their many helpful suggestions.

The writer is indebted to the California Division of Fish and Game, Bureau of Game Conservation, for the loan of equipment and the invaluable aid of its personnel, particularly Fred Ross who built the first large insectary. Appreciation is also extended to Messrs. Ian McMillan, Ernest Twisselman, Henry Childs, Lester Hink and David Selleck for ganting this writer permission to trap quail on their ranches.

O'Roke also tried to obtain flies by trapping quail in a sparrow trap. To prevent the escape of flies from trapped birds he placed a gauze cover over the trap. He failed to obtain any flies in this manner.

For his third experiment O'Roke placed a wire cage containing a quail near a feeding area of wild quail in hopes that the flies on the free birds would be attracted to the captive bird, but this was not successful either.

Herman obtained hippoboscid flies by trapping quail in regular quail traps. These flies were placed in small, screened cages containing quail which were transported from the field to the laboratory. Herman was able to obtain both species common to the quail; namely, *Stilbometopa impressa* (Bigot) and *Lynchia hirsuta* Ferris.

In order for the writer to carry out a research program relating to the transmission of the *Haemoproteus* of the California Valley Quail, *Lophortyx californica vallicola* (Ridgway), by the bite of the quail hippoboscids, *Stilbometopa impressa* and *Lynchia hirsuta,* a large number of these flies had to be secured. The one successful method described by O'Roke for taking hippoboscids was not practicable for these studies. It meant the sacrifice of too many birds, blood studies on dead birds would be almost impossible, and the number of birds one could work with would be greatly limited by conservation and hunting laws, as well as one's markmanship.

Herman's methods, both those reported in the literature and those reported verbally to the writer, were used with some additions and modifications.

Quail Trapping

A great many of the trapping techniques used in these studies are those worked out by the personnel of the California Division of Fish and Game, Bureau of Game Conservation. Without the Bureau's splendid cooperation and assistance this project would have been almost impossible to accomplish.

For the inexperienced it might be wise to mention that before attempting to collect any birds, one should inquire of his State and Federal Game Agencies about the necessary scientific collecting permits. These local game agencies as well as Game Wardens should be consulted as to which area or areas contain the greatest number of the species of birds being sought.

During the present studies field headquarters were established in known quail-populated areas. A survey was then made of the immediate vicinity to determine the population of the various coveys, the locations of the coveys and their feeding and watering

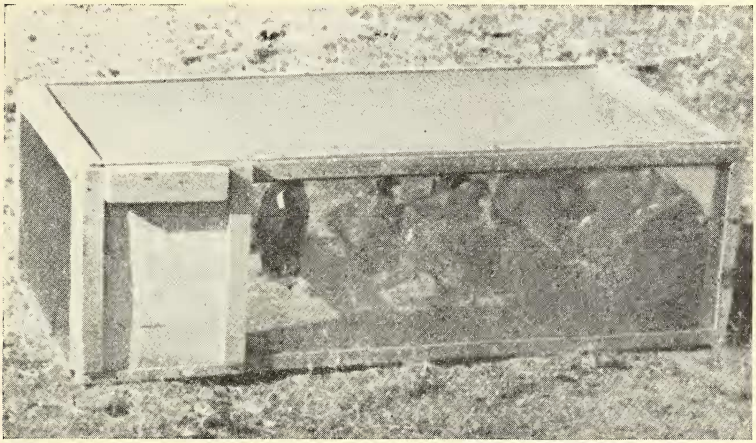

Fig. 1. Flyproof holding cage containing quail.

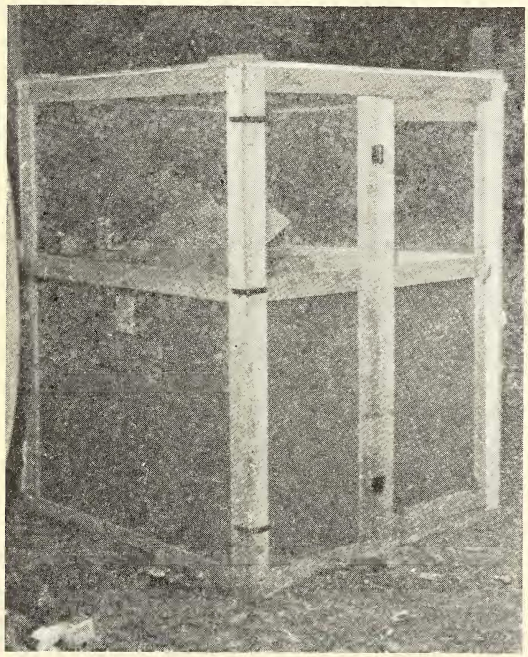

Fig. 2. Large insectary in use. Note how the sheets of masonite and the screening are fastened on the inside of the framework.

areas. Once these areas were located, the exact sites for the traps were determined and bait was scattered over these sites. Poultry scratch feed was found to be most satisfactory as a bait for quail. Such baits as wheat, barley, rice, onion and lettuce seeds were used with fair success.

When the quail became accustomed to eating the bait, traps were placed on the sites with the doors open. Bait was scattered over the same sites with the heaviest concentrations inside the traps. The traps were camouflaged with the flora peculiar to the area so that the birds would not be frightened away.

Quail traps of various sizes and construction were used.

After the opened traps were set up from two to three days, the doors were closed and the trapping begun. The baiting was continued as before. If this procedure is followed closely, one can obtain good catches.

Quail traps were checked twice a day, between 8:00 a.m. and 10:00 a.m. in the morning, and just after dusk in the evening. Quail expire quite readily if left exposed to the direct sun or extreme heat for even short periods of time; therefore, the morning collection hour should be adjusted according to prevailing temperatures in the area. The evening collection should never be omitted or delayed too long after dark as birds left in the traps are easy prey for predators.

Wooden cages similar to the cardboard containers used to transport young chicks are generally used for collecting birds from the traps and transporting them from one area to another. These cages have open air vents and work very satisfactorily when the loss of flies is of no consequence. Since burlap sacks are flyproof, it was suggested that the writer use these in place of the regular wooden cages for transporting birds. This practice proved most costly as far as birds were concerned since the quail sometimes huddled together in the almost airless sacks and completely smothered one another. After using the sacks a few times, the writer devised a flyproof holding cage that was much more successful (Fig. 1).

Each flyproof holding cage was designed to hold approximately twenty birds. The cage measured 18 inches in width, 24 inches in length and 8 inches in height. The framework consisted of 1×1 inch finished fir stock. The bottom of the cage was fitted with a piece of three-eighth inch plywood. The sides and top were covered with #16 mesh bronze screen cloth. The screen cloth was tacked down on the outside of the framework and covered

with one-half inch batting to prevent the screen cloth from unraveling. A sliding galvanized sheet metal door (#28 gauge) was placed at one end of the long side of the cage (Fig. 1).

To remove the quail from a trap the holding cage was placed adjacent to the release door of the trap and the birds were gently coaxed into the holding cage. Once the birds were removed to the holding cages they could easily be transported to the field laboratory (Fig. 2).

Portable Insectaries

To facilitate the removal of flies from the trapped birds, and to insure the recovery of the total number of flies on each bird, two flyproof field insectaries were devised and built. These insectaries have been a major factor in the success of the writer's entire research program.

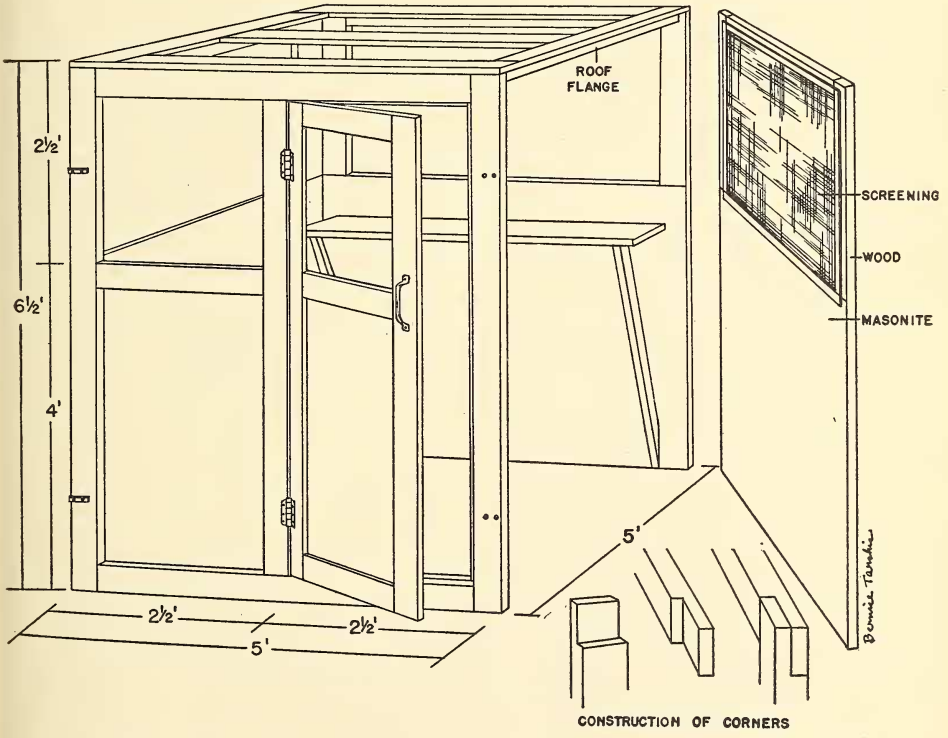

Fig. 3 Large insectary. One side is shown removed and the screen cloth has been omitted on all but the removed side to clarify the details of construction.

The large insectary was best used when large-scale trapping operations were in progress. The small insectary was most ideal for limited trapping operations and indoor work.

The large insectary (Figs. 2 and 3) was a collapsible house five feet square and six and one-half feet high. The house was built in five separate sections: a roof and four sides. One side was fitted with a door. The framework of each section was made of 1×4 inch unfinished fir stock. The bottom portion of each side of the house was fitted with a sheet of masonite 4×5 feet (the 4 foot measurement being vertical). Each sheet of masonite was fastened to the 1×4 framework on the inside so that the inner walls of the assembled house formed a smooth, unbroken surface. Since the masonite is generally brown in color and the flies are various shades of brown to black, the masonite walls on the inside of the house were painted white so that the flies could be easily seen when they flew onto the masonite. For the same reason the house was generally set up on a large white canvas.

The remaining two and one-half feet of each side were covered with #16 mesh bronze screen cloth. The screen cloth was tacked down on the inside of the framework. One inch fir batting was placed over the tacked edges of the screen cloth.

The roof of the house consisted of a framework of 1×4 inch unfinished fir stock. A piece of 1×4 inch fir stock was placed across the center of the framework for added support. The roof was covered with #16 mesh bronze screen cloth and one inch batting was placed over the tacked down edges. There was a flange all the way around the underside of the roof. This was attached one inch in from the outside edge. This flange kept the roof from slipping off the top of the house and helped steady the upright sides of the house. The house was held together at each corner by two, four inch right angle irons. A hinged shelf, supported by two removable supports, was attached along one inside wall of the house. A small door was placed in one wall so that birds could be released as they were examined.

The large insectary could be assembled and taken apart with the utmost ease and was light enough for one man to handle without difficulty. The convenience with which the unassembled insectary could be stored when not in use was another great advantage. The house was large enough to accommodate two men with ease and three men without difficulty when necessary. A two man team could easily defly, blood smear, band, and record all the necessary information on a great number of birds each day. The assembled house is shown in Fig. 2.

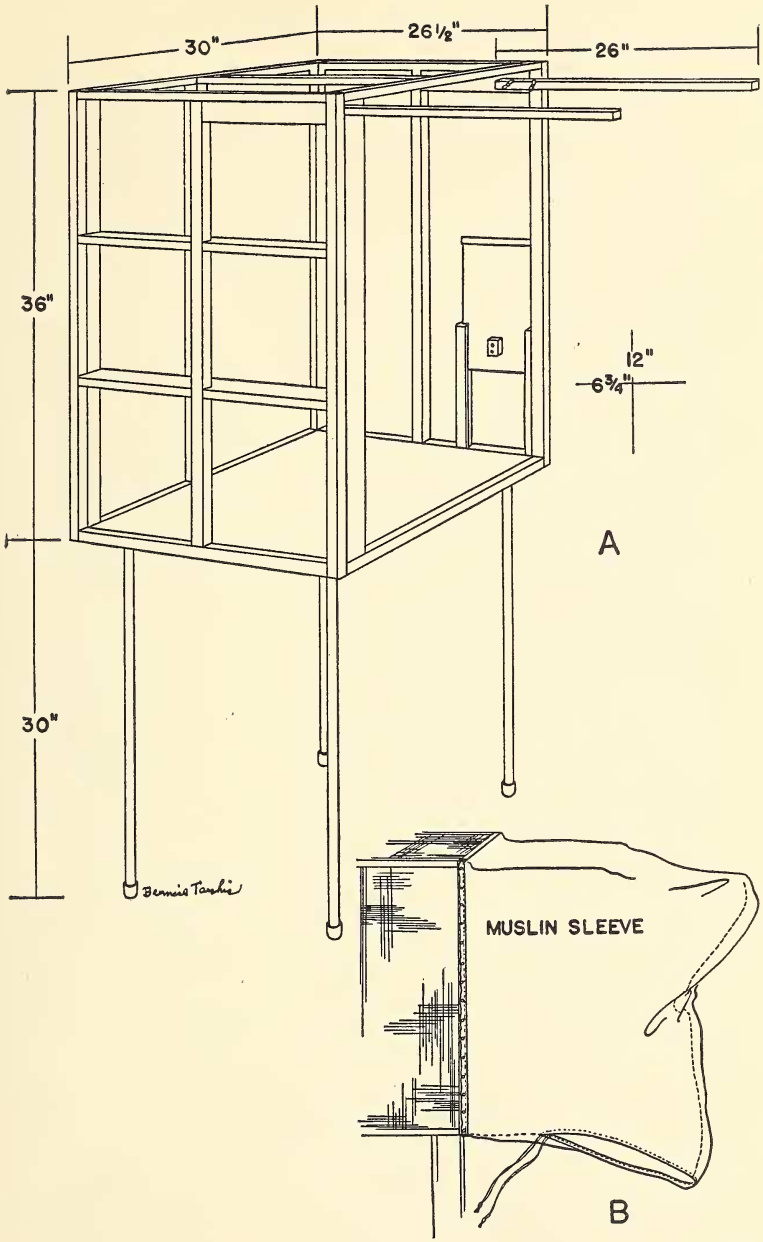

Fig. 4 Small insectary. A, shows insectary before addition of screen cloth and muslin sleeve. B, shows tailoring of muslin sleeve and its attachment to the front of the insectary. The top edge has been tacked and covered with batting, the side edge has been tacked only.

The small insectary was built for a dual purpose. It was used in the field when one man was working alone. It was also used as an insectary in the main laboratory where it was used for deflying quail, introducing flies onto quail, and for a host of other experimental purposes. It was especially valuable indoors since it took up so little space.

This insectary consisted of three screened sides, a screened top, a solid wooden bottom, and a large canvas "sleeve" attached to the fourth side (Figs. 4 and 5). The insectary was 30 inches long, $26\frac{1}{2}$ inches wide, and 36 inches high. The framework was 1×1 inch finished fir stock. The bottom of the insectary was fitted with a three-fourth inch piece of plywood. Number 16 mesh bronze screen cloth was attached on the outside of the insectary with carpet tacks and further secured with one-half inch fir batting. One side of the insectary was fitted with a galvanized sheet metal door (# 28 gauge) through which the deflied quail were released when the insectary was used in the field. Several shelves were also fitted on one inside wall to hold all the necessary equipment. See Figs. 4A and B for the construction of the insectary.

The small insectary was supported by four, three-fourth inch, galvanized metal pipe legs. The bottoms of these legs were fitted with ordinary pipe caps. The legs were screwed into four, three-fourth inch floor flanges permanently attached at the corners on the underside of the insectary. These legs were removable.

The sleeve was made of heavy 54 inch wide unbleached muslin. A piece of muslin 3 7/9 yards long was used for the sleeve. One selvage edge was tacked down to the framework (Fig. 4B), and the other selvage edge was seamed together. Twelve inches of the open bottom end were sewed together, the remaining portion was hemmed to form a tunnel through which a cord was run (Fig. 4B). The seated worker put the sleeve over his head and then drew the cord up snugly around his waist (Fig. 5).

Two 26 inch removable wooden bars were placed on the inside near the top of the insectary so that the muslin sleeve would be held up out of the operator's way (Fig. 4A and Fig. 5).

Examination of Birds For Flies

After the quail were removed from the traps and placed in the screened holding cages they were taken to the field insectary where they were examined for flies, banded, sexed and aged, and blood smeared. When the large house was used several of the holding cages were brought into the house and the examination work went on uninterrupted until all the birds were checked. When the small

insectary was used, about fifteen quail at a time were placed in a small holding cage which was placed in the insectary.

Hippoboscid flies have the ability to adhere rather tenaciously to the hosts' feathers. It was therefore necessary to ruffle the birds' feathers for a considerable period of time in order to force all the flies to leave the bird. The degree of tenacity was dependent upon the prevailing temperature. During the early morning hours and during the colder months the flies clung so tenaciously to the feathers that they had to actually be pulled off. When the flies are not feeding they are most generally located near the tail end of the bird's body. When the flies are feeding they are generally situated

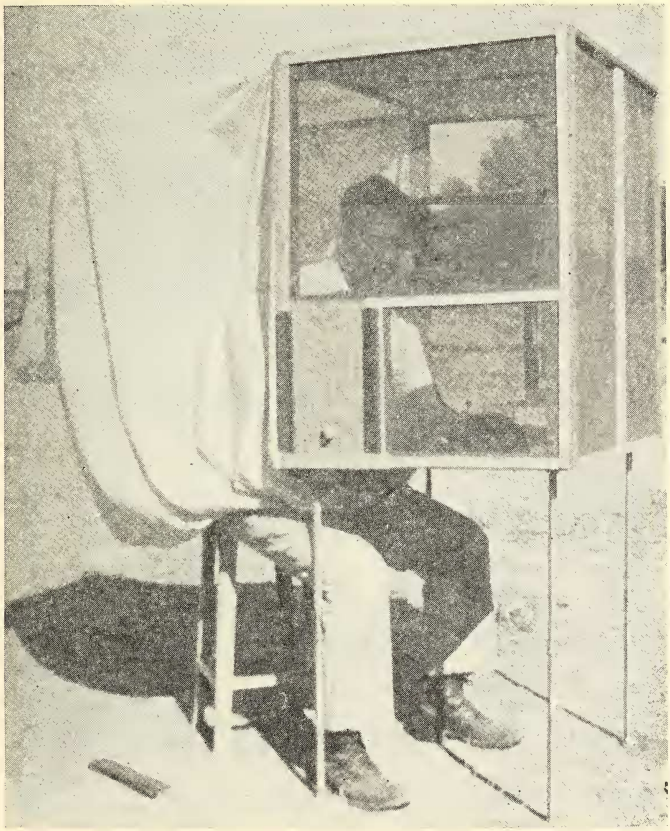

Fig. 5. Small insectary in use. Note manner in which extending arms at top of the insectary hold up the muslin sleeve and keep it out of the worker's way. Also note manner in which muslin sleeve is drawn up around the worker's waist.

under the feathers near the neck. It is therefore necessary to ruffle all the feathers on the bird's body in order to get all the flies present.

Stilbometopa impressa and *Lynchia hirsuta* are both positively phototropic. Flies flushed from the birds almost always headed for the side of the insectary having the greatest amount of light; thus, the flies were generally recovered from the screened portion of the insectary. Once the flies alighted they were easily urged into shell vials.

No matter which insectary was used by the writer, he was able to take all the flies present on the birds examined. To date close to 1600 adults of *Stilbometopa impressa* and more than 1000 adults of *Lynchia hirsuta* have been taken from trapped quail.

Selected Bibliography

O'Roke, Earl C. 1930. The Morphology, Transmission, and Life History of *Haemoproteus lophortyx* O'Roke, a Blood Parasite of the California Valley Quail. Univ. Cal. Pub. Zool. Vol 36(1): 1–50.

Herman, C. M. 1944. Notes on the Pupal Development of *Stilbometopa impressa* (Diptera: Hippoboscidae). Jour. Parasit. Vol. 30(2): 112–118.

NOTICE

A special sale of all overstock reprints of articles which have appeared in the new series of **Entomologica Americana** since 1926 is now in progress. A price list may be obtained from George S. Tulloch, 22 East Garfield Street, Merrick, N. Y.

Positive microfilm prints of the Synopsis of the Principal Larval Forms of Coleoptera by Boving & Craighead (Vol. 11 of Entomologica Americana) are now available for sale at three dollars each. Send orders to Mr. R. R. McElvare, 26 Bogart Avenue, Port Washington, N. Y.